PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-206643
(43)Date of publication of application : 07.08.1998

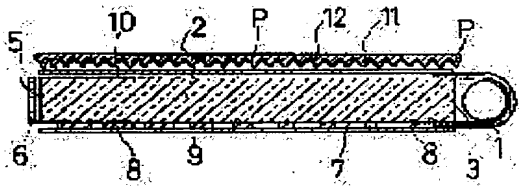
(51)Int.Cl. G02B 6/00
F21V 8/00
G02B 5/04
G02F 1/1335

(21)Application number : 09-020958
(22)Date of filing : 20.01.1997

(71)Applicant : MINEBEA CO LTD
(72)Inventor : SUZUKI SHINGO

(54) SHEET-LIKE LIGHT SOURCE DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a high intensity sheet-like light source device by which a beam of light is advanced with high efficiency and electric power consumption can be reduced by arranging a prism plate on a surface of a resin base board, and specifying an angle of an incident surface of the beam of light emitted from a light source lamp.
SOLUTION: A light scattering pattern 8 is formed on the reverse 7 of a resin base board 2, and a reflecting plate 9 is arranged under it. A cloudiness value of the light scattering pattern is set not more than 80%. A duffusive plate 11 is arranged on a surface 10 of the base board 2, and a prism plate 12 is arranged above it so that a prism unit P is positioned in the direction opposed to the base board 2. In a surface to constitute the prism unit P, an inclination of an incident surface on which a beam of light incident on the prism plate 12 advances is set not less than 70° , preferably more than 75° . However, it is desirable that the inclination is selected as 80° or less in the aspect of work of the prism plate 12.



LEGAL STATUS

[Date of request for examination] 05.11.1999
[Date of sending the examiner's decision of rejection] 06.08.2002
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

[Claim(s)]
[Claim 1] In the source equipment of sheet-like light of the side light method of the resin substrate which consists of a translucency ingredient which a light source lamp is made to contact near the side edge side beyond the whole surface at least, and is constituted The field which has this prism unit in the prism plate equipped with a prism unit at equal intervals is established in the front face of said resin substrate at the sense which contacts said resin substrate. Furthermore, source equipment of sheet-like light characterized by having made into 70 degrees or more the include angle of the plane of incidence at the time of the beam of light emitted from said light source lamp carrying out incidence to a prism plate, having prepared the light-scattering pattern made to reflect a beam of light in the rear face of said resin substrate, and making haze value of this dispersion pattern into 80% or less.
[Claim 2] Source equipment of sheet-like light according to claim 1 characterized by forming a diffusion plate in the upper part and the lower part of said prism plate.
[Claim 3] Said resin substrate is source equipment of sheet-like light according to claim 1 or 2 characterized by being the cross-section configuration **** wedge from which thickness subtracts a light source lamp as it keeps away from the side edge side which contacted.
[Claim 4] Said light-scattering pattern is source equipment of sheet-like light according to claim 1 to 3 characterized by being printed by the resin substrate using the ink containing the light-scattering matter.
[Claim 5] Said light-scattering pattern is source equipment of sheet-like light according to claim 1 to 3 characterized by being formed in the rear face of said resin substrate by giving a minute concavo-convex side.
[Claim 6] The prism unit of said prism plate is equipped with the beam-of-light directional change side where the beam of light which carried out incidence from said plane of incidence in which a beam of light carries out incidence, and this plane of incidence advances. Whenever [tilt-angle / of said plane of incidence] theta 2, It is theta 3 whenever [tilt-angle / of said beam-of-light directional change side]. And include angle theta 0 in which a beam of light carries out incidence to a prism plate Source equipment of sheet-like light according to claim 1 to 5 characterized by relation filling {Sin (theta2-theta0)/n}-theta2 / 2.
[theta3 =90 degree+[Sin-1]

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the structure of the source equipment of sheet-like light especially used as a backlighting means of a liquid crystal display about the thin source equipment of sheet-like light used for backlighting means, such as a signboard and various displays.
[0002]
[Description of the Prior Art] In recent years, as displays, such as a computer, the liquid crystal display which has a legible tooth-back light source device with a thin shape is used in order to respond to the needs of a light weight and miniaturization. As a means to realize such a tooth-back light source device, the source equipment of sheet-like light of the side light method (light guide plate method) shown in drawing 10 is explained. 21 is the light source lamp of the shape of a straight line which uses a cold cathode tube (CCFL) or a hot cathode tube (HCFL) as the light source of the source equipment of sheet-like light. The resin substrate 22 formed with the high ingredient of translucency is a cross-section configuration **** rectangle, along the 1 side-edge side 23, sets said light source lamp 21, and arranges predetermined distance.
[0003] In the peripheral surface of the light source lamp 21, the 1 side-edge side 23 and the peripheral surface which does not counter are covered by the lamp reflector 24 which vapor-deposited silver etc. By forming the lamp reflector 24, many of luminescence beams of light of the light source lamp 21 can advance into the resin substrate 22 from the 1 side-edge side 23. And the reflector 26 which consists of a reflective tape etc. is added to side faces other than 1 side-edge side 23 of the resin substrate 22 (for example, side edge side 25 which is an opposed face of the 1 side-edge side 23 shown in drawing 10 and

drawing 11).

[0004] The light-scattering pattern 28 (detail after-mentioned) for making the screen of the source equipment of sheet-like light emit light to homogeneity, without being influenced from the light source lamp 21 to distance is formed in the rear face 27 (lower part of drawing 10) of the resin substrate 22, and, below, the reflecting plate 29 is arranged at the pan. By forming these reflectors 26 and a reflecting plate 29, the beam of light which advances toward the side face and rear face 27 of the resin substrate 22 was reflected so that it might go on inside the resin substrate 22, and it has prevented that a beam of light emits from fields other than surface 30 (upper part of drawing 10) of the resin substrate 22.

[0005] And the diffusion plate 31 is formed in the front face 30 of the resin substrate 22 so that the whole surface may be covered. The diffusion plate 31 is formed in order to remove the phenomenon (this is usually called dot image) only the light-scattering pattern 28 resulting from the beam of light reflected and diffused shines and appears with the light-scattering pattern 28.

[0006] The medium containing the optical diffuse reflection matter is applied to said light-scattering pattern 28 by the screen-stencil method over the shape of a dot all over rear-face of resin substrate 22 27 so that it may be indicated by JP,5-134251,A.

[0007] As shown in drawing 11 , the light-scattering pattern 28 Since it is printed so that the path of a dot may become large gradually as it goes to the side edge side 25 which is the opposed face from the 1 side-edge side 23 in which the light source lamp 21 is arranged The rate that the medium which contained the optical diffuse reflection matter in per unit area of a rear face 27 occupies increases as it becomes far from the light source lamp 21 (the rate that the predetermined matter occupies is hereafter said to per unit area as an area consistency). In drawing 11 , although the light-scattering pattern 28 was not a cross section, it gave the slash so that intelligibly.

[0008] Thus, if the area consistency of the light-scattering pattern 28 which applies and gives the medium containing the optical diffuse reflection matter formed in the rear face 27 of the resin substrate 22 is changed, since the amount of beams of light emitted from the front face 30 of the resin substrate 22 can be changed, only the part near the light source lamp 21 does not emit light brightly.

[0009] Moreover, as it replaces with the light-scattering pattern 28 given to the resin substrate 22 by the screen-stencil method as mentioned above, for example, is shown in Japanese Patent Application No. No. 208461 [seven to], it is also possible to demonstrate a function equivalent to the above-mentioned light-scattering pattern 28 by forming a directly minute concavo-convex field in the rear face 27 of the resin substrate 22, and forming the light-scattering pattern 28 (referring to drawing 12) made to diffuse and/or reflect light according to the concavo-convex field.

[0010] By the way, since the above-mentioned diffusion plate 31 has the property to diffuse the beam of light which advances the diffusion plate 31 interior, it will pile up a beam of light, and it can remove a dot image. Therefore, if the diffusibility of the diffusion plate 31 is made to increase, a dot image will become that it is easier to be removed, but simultaneously, since a beam of light will diffuse, brightness will fall. For this reason, the lowest diffusion plate 31 of diffusibility is chosen in the range which can remove a dot image.

[0011] As it replaces with this, for example, is shown in Japanese Patent Application No. No. 97633 [eight to], drawing 12 and the source equipment of sheet-like light of drawing 13 are indicated. Although the configuration is almost the same as that of the source equipment of sheet-like light shown in drawing 10 and drawing 11 , let it be the pattern made detailed by the time it could not check the configuration of the light-scattering pattern 28 by looking instead of forming the diffusion plate 31 in the front face 30 of the resin substrate 22. Thus, since the pattern of the light-scattering pattern 28 is fine even if the advancing beam of light diffuses and/or reflects the interior of the resin substrate 22 by the light-scattering pattern 28 when the light-scattering pattern 28 made detailed is given, only the light-scattering pattern 28 shines and does not appear.

[0012] Here, the light-scattering pattern 28 shown in drawing 12 and drawing 13 is formed of the minute concavo-convex field which functions almost identically to the light-scattering pattern 28 (refer to drawing 10) given by the screen-stencil method. moreover, thickness decreases as the configuration of the resin substrate 22 keeps away from the 1 side-edge side 23 of the light source lamp 21 in drawing 12 -- it is a wedge shape mostly. When it considers as such a resin substrate 22, it is effective in lightweight-izing of the resin substrate 22.

[0013] Drawing 14 is a typical sectional view for explaining the progress condition of the beam of light in the source equipment of sheet-like light of the side light method constituted in this way. In the source equipment of sheet-like light of a configuration of having mentioned above, when the luminescence beam of light from the light source lamp 21 reflects in the wrap lamp reflector 24 except the field which counters the 1 side-edge side 23, the many advance inside the resin substrate 22.

[0014] It is reflected with the rear face 27 of the resin substrate 22, or is spread and reflected by the light-scattering pattern 28, or a rear face 27 and the light-scattering pattern 28 are passed, it is reflected with the downward reflecting plate 29, and the luminescence beam of light from the light source lamp 21 which runs toward a rear face 27 advances toward a front face 30. And the diffusion plate 31 equipped above the front face 30 is penetrated. At this time, a dot image is removed by diffusing the beam of light which advances the inside of the diffusion plate 31 to some extent. On the other hand, the luminescence beam of light from the light source lamp 21 which runs toward a front face 30 is the front face of the resin substrate 22, and the many are reflected and it advances toward a rear face 27.
[0015] Thus, the beam of light which advances the inside of the resin substrate 22 advances, repeating an echo in the front face 30 of the resin substrate 22 and a rear face 27, and the interface of a reflector 29. Hereafter, it repeats until it is emitted on a screen. Here, since many of beams of light diffused and reflected by the light-scattering pattern 28 advance at the predetermined include angle which is not reflected in an interface, it is emitted on a screen.
[0016] Since the rate reflected by the light-scattering pattern 28 increases as the beam of light which advances the inside of the resin substrate 22 by having given distribution of the area consistency mentioned above to the light-scattering pattern 28 becomes far from the light source lamp 21, the source equipment of sheet-like light of uniform screen luminescence is realizable irrespective of the arrangement location of the light source lamp 21.
[0017] By the way, when the diffusibility of said light-scattering pattern 28 is large, the beam of light which carries out outgoing radiation from the front face 30 of the resin substrate 22 has the problem that the absorption loss by the light-scattering pattern 28 becomes large in this case since diffusibility is large, although it is observed comparatively brightly from [of the source equipment of sheet-like light] a transverse plane (henceforth an observation post) since the angular distribution of a travelling direction becomes large. For this reason, when the diffusibility of the light-scattering pattern 28 is reduced, the travelling direction of the chief ray of the beam of light which carries out outgoing radiation has predetermined include-angle theta0 inclination (refer to drawing 14) from the front face 30 of the resin substrate 22 to a screen perpendicular direction. In such a case, from an observation post, a screen will be observed darkly.
[0018] This include angle theta 0 As a means to change a chief ray into a screen perpendicular direction, and to aim at improvement in brightness, the source equipment of sheet-like light shown in drawing 15 is devised as indicated by the utility model registration official report No. 2507092. although the configuration of the source equipment of sheet-like light shown in drawing 15 is almost the same as that of the source equipment of sheet-like light explained based on drawing 10 -- the screen side (upper part of drawing 15) of the diffusion plate 31 -- a wrap -- it differs in that the prism plate 32 was formed like. The prism plate 32 can be equipped with the prism train in which the prism unit P of a cross-section configuration triangle was made to arrange, and can be made to change into a screen perpendicular direction the bleedoff include angle of the beam of light emitted on a screen by reflecting a beam of light in this prism unit P.
[0019] Drawing 16 is drawing having shown typically progress of the beam of light to the prism plate 32 in the source equipment of sheet-like light shown in drawing 15 . In this drawing, since the light source lamp which is not illustrated is located in right-hand side, the beam of light which carries out incidence to the prism plate 32 advances to the field (henceforth the beam-of-light directional change side 33) of the left-hand side in the prism unit P. Since incidence is carried out to the prism plate 32 formed in the upper part, the beam of light which carries out outgoing radiation from the diffusion plate 31 in drawing 15 is an include angle theta 0 about whenever [to the prism plate 32 / incident angle] (namely, outgoing radiation include angle from the diffusion plate 31). It carries out. In addition, although the beam of light which carried out outgoing radiation from the resin substrate 22 carries out incidence to the prism plate 32 in not forming the diffusion plate 31, it is an include angle theta 0. You may consider it **** the same way.
[0020] It is whenever [tilt-angle / as opposed to the level surface of the prism plate 32 of the beam-of-light directional change side 33 at this time] theta 1 It carries out. It is theta 1 whenever [tilt-angle]. It is known mathematically that it can be found with the following formula 1.
[0021] Sintheta1 =Sintheta0/{n2+1-2(n2-Sin 2theta0) 1 / 2} 1/2 [0022] In the above-mentioned formula 1, n is the refractive index of a base material, i.e., the refractive index of the prism plate 32. It creates with the acrylic resin of a refractive index 1.49, and the prism plate 32 is an include angle theta 0. When it is 50 degrees, it is theta 1 whenever [tilt-angle] at the above-mentioned formula 1. If it calculates, it will become about 70 degrees.
[0023] It is theta 1 whenever [tilt-angle / which is obtained with this formula 1]. The prism plate 32

which it has is examined below based on the mimetic diagram of drawing 17 and drawing 18 . Here, the prism plate 32 of conditions (include angle theta whenever [0 = 50 and tilt-angle / theta] n= 1.49, 1 = 70) for which it asked by above-mentioned count was examined.

[0024] As shown in drawing 17 , the vertical perpendicular A is considered to the level surface of the prism plate 32, and the direction of incidence of a beam of light is defined as + side. It is theta 1 whenever [tilt-angle]. When it is 70 degrees, the Fresnel reflection loss at the time of a beam of light being refracted increases as -20 degrees becomes max and, as for the outgoing radiation range by the side of -, approaches -20 degrees. Furthermore, the field which cannot change the travelling direction of a beam of light will be made by carrying out total reflection of the beam of light.

[0025] And as shown in drawing 18 , it is theta 1 whenever [tilt-angle]. Include angle theta 0 which makes 70 degrees and carries out incidence to the prism plate 32 It is made to change, the outgoing radiation include angle psi of the chief ray from the beam-of-light directional change side 33 and the permeability of a beam of light are measured, and the relation is shown in drawing 19 . It is theta 1 whenever [tilt-angle] so that clearly from the graph shown in drawing 19 . When the prism plate 32 made into 70 degrees is used, the outgoing radiation include angle psi is [about]. -Since it had become the range of 20 to +20 degrees, it turned out that whenever [angle-of-visibility / at the time of observing from a screen] is extremely narrow. And since light transmission fell remarkably when the width of face of the outgoing radiation include angle psi becomes large, it turned out that effectiveness falls.

[0026] It replaces with the source equipment of sheet-like light of drawing 15 mentioned above, and the source equipment of sheet-like light with which the source equipment of sheet-like light shown in drawing 20 is indicated by JP,7-27136,B is invented. Although this source equipment of sheet-like light is the almost same structure as the source equipment of sheet-like light shown in drawing 15 , arrangement of the prism plate 32 differs and it arranges the prism unit P of the prism plate 32 to the sense which contacts the resin substrate 22.

[0027] Thus, when the prism plate 32 is arranged, as it is shown in the mimetic diagram showing the travelling direction of the beam of light of drawing 21 , the field which constitutes the prism unit P will constitute the plane of incidence 34 and beam-of-light directional change side 33' to which the beam of light which carries out incidence to the prism plate 32, respectively advances. Here, it is whenever [tilt-angle / of theta 2 and beam-of-light directional change side 33'] about whenever [tilt-angle / of plane of incidence 34] theta 3 It sets.

[0028] As conditions for the prism unit P suitably used for the example of this JP,7-27136,B as source equipment of sheet-like light Include angle theta 0 When the prism plate 32 is produced with acrylic resin at 55 degrees, it is theta 2 whenever [tilt-angle]. At the time of 58 degrees thru/or 48 degrees It is theta 3 whenever [tilt-angle]. It considers as 65 degrees thru/or 75 degrees, and is theta 2 whenever [tilt-angle]. It is theta 3 whenever [tilt-angle] at the time of 65 degrees thru/or 75 degrees. It is indicated that they are 58 degrees thru/or 48 degrees. As this typical configuration, it is theta 2 whenever [tilt-angle]. It is theta 3 whenever [55 degree and tilt-angle]. It may be 68 degrees.

[0029]

[Problem(s) to be Solved by the Invention] Here, it is theta 2 whenever [tilt-angle / which is indicated by that of JP,7-27136,B]. It is theta 3 whenever [55 degree and tilt-angle]. Progress of the beam of light in the prism plate 32 which has the prism unit P made into 68 degrees is considered.

[0030] If the plane of incidence 34 of the prism unit P and beam-of-light directional change side 33' are determined as mentioned above as shown in drawing 22 , the outgoing radiation beam of light from the prism plate 32 inclines on the right-hand side of 15 degree so much in the direction of a transverse plane. If include-angle theta0 =55 degree of the beam of light which carries out incidence to the prism plate 32, the beam-of-light band B which runs to beam-of-light directional change side 33' among the beams of light which carry out incidence from plane of incidence 34 will be emitted from the prism plate 32 at an angle of a request, but since the beam-of-light band C which does not run to beam-of-light directional change side 33' runs to the interface (upper part of drawing 22) of the prism plate 32, it has the problem will be lost.

[0031] For this reason, as compared with the source equipment of sheet-like light explained based on drawing 15 , constraint of whenever [angle-of-visibility] was not the thing of what is lost which can still be satisfied in respect of effectiveness. that is, in order to solve the above-mentioned trouble, in case this invention results as a result of various examination and advances a beam of light in the direction of a transverse plane of a screen using a prism plate, it offers the prism plate which may advance a beam of light to a well head more, and, thereby, falls power consumption -- making -- and high -- it aims at offering the brightness source equipment of sheet-like light.

[0032]

[Means for Solving the Problem] As The means for solving a technical problem, in invention of claim 1 In

the source equipment of sheet-like light of the side light method of the resin substrate which consists of a translucency ingredient which a light source lamp is made to contact near the side edge side beyond the whole surface at least, and is constituted The field which has this prism unit in the prism plate equipped with a prism unit at equal intervals is established in the front face of said resin substrate at the sense which contacts said resin substrate. Furthermore, it is source equipment of sheet-like light characterized by having made into 70 degrees or more the include angle of the plane of incidence at the time of the beam of light emitted from said light source lamp carrying out incidence to a prism plate, having prepared the light-scattering pattern made to reflect a beam of light in the rear face of said resin substrate, and making haze value of this dispersion pattern into 80% or less.

[0033] In invention of claim 2, it is characterized by forming a diffusion plate in the upper part and the lower part of said prism plate.

[0034] In invention of claim 3, said resin substrate is characterized by being the cross-section configuration **** wedge which thickness reduces as it keeps away from the side edge side which contacted the light source lamp.

[0035] In invention of claim 4, said light-scattering pattern is characterized by being printed by the resin substrate using the ink containing the light-scattering matter.

[0036] In invention of claim 5, said light-scattering pattern is characterized by being formed in the rear face of said resin substrate by giving a minute concavo-convex side.

[0037] In invention of claim 6, the prism unit of said prism plate It has the beam-of-light directional change side where the beam of light which carried out incidence from said plane of incidence in which a beam of light carries out incidence, and this plane of incidence advances. It is [whenever / tilt-angle / of said plane of incidence] theta 3 whenever [tilt-angle / of theta 2 and said beam-of-light directional change side]. And include angle theta 0 in which a beam of light carries out incidence to a prism plate Relation is characterized by filling {Sin (theta2-theta0)/n}-theta2 / 2. [theta3 =90 degree+[Sin-1]

[0038]

[Embodiment of the Invention] The source equipment of sheet-like light as a gestalt of operation of the first of this invention is shown in drawing 1 thru/or drawing 3 . As shown in drawing 1 and drawing 3 , 1 is a light source lamp which is the straight-line-like light source. The resin substrate 2 formed with the high ingredient of translucency is a cross-section configuration **** rectangle, along the 1 side-edge side 3, sets said light source lamp 1, and arranges predetermined distance. The peripheral surface of the light source lamp 1 except countering the 1 side-edge side 3 of the resin substrate 2 is covered by the lamp reflector 4 which vapor-deposited silver etc. And the reflector 6 is formed in side faces other than 1 side-edge side 3 of the resin substrate 2 (for example, side edge side 5 which is an opposed face of the 1 side-edge side 3).

[0039] The light-scattering pattern 8 for making the screen of the source equipment of sheet-like light emit light to homogeneity in the rear face 7 (lower part of drawing 1) of the resin substrate 2 is formed in the pattern configuration shown in drawing 3 by the screen-stencil method or spreading, and, below, the reflecting plate 9 is arranged at the pan. And in order to remove a dot image so that the whole surface may be covered, the diffusion plate 11 is formed in the front face 10 of the resin substrate 2. Furthermore, the prism plate 12 which is the important section of this invention locates the prism unit P in the sense which counters the resin substrate 2, and is formed in the upper part. Here, the prism unit P which constitutes the prism plate 12 shall be produced based on the conditions mentioned later.

[0040] The include angle of the prism unit P of the prism plate 12 is explained below. The gestalt of this operation explains the source equipment of sheet-like light which formed the haze value of the light-scattering pattern 8 as 70%. Since the prism unit P of the prism plate 12 is arranged at the sense which counters the resin substrate 2, as the beam of light which carries out incidence to the prism plate 12 is shown in the mimetic diagram showing the travelling direction of the beam of light of drawing 2 , the field which constitutes the prism unit P constitutes the plane of incidence 13 and the beam-of-light directional change side 14 where the beam of light which carries out incidence to the prism plate 12, respectively advances. It is whenever [tilt-angle / of theta 2 and the beam-of-light directional change side 14] about whenever [tilt-angle / of plane of incidence 13] theta 3 It sets.

[0041] And in order to advance the beam-of-light directional change side 14, and to make all the chief rays of the beam of light which carries out incidence from plane of incidence 13 refracted in the vertical direction of a transverse plane to a screen and to make a beam of light emit from the prism plate 32 as shown in drawing 2 , it is [whenever / tilt-angle] theta 3 whenever [theta 2 and tilt-angle]. And include angle theta 0 in which a beam of light carries out incidence to the prism plate 12 It drew as a formula 2 showing relation below. In order to consider as the prism plate 12 of the above-mentioned request, the prism unit P satisfies a formula 2 mostly.

[0042] {Sin (theta2-theta0)/n}-theta2 / 2 [0043] [theta3 =90 degree+[Sin-1] In the above-mentioned formula 2, n is the refractive index of a base material, i.e., the refractive index of the prism plate 12. It is [whenever / tilt-angle / which is drawn by the above-mentioned formula 2] theta 3 whenever [theta 2 and tilt-angle]. And include angle theta 0 Relation is shown in the graph of (a) of drawing 4 , and (b). Drawing 4 (a) is the case where the prism plate 12 is produced with the acrylic resin of a refractive index 1.49, and, on the other hand, drawing 4 (b) is the case where the prism plate 12 is produced with the acrylic resin of a refractive index 1.49.

[0044] By considering as the prism plate 12 equipped with the prism unit P with which the above-mentioned formula 2 is filled, it is the predetermined include angle theta 0. Since the beam of light which carries out incidence can be made refracted in the direction of a transverse plane and all the chief rays of the incident ray advance to the beam-of-light directional change side 14, loss can be abolished.

[0045] Then, the source equipment of sheet-like light shown in drawing 5 and drawing 6 is shown as a gestalt of operation of the second of this invention. Since a different part from the gestalt of the first operation is only the configuration and the light-scattering pattern 8 of the resin substrate 2, it explains only a point of difference. thickness reduces the configuration of the resin substrate 2 as it keeps away from the 1 side-edge side 3 of the light source lamp 1 -- it considered as the wedge shape mostly. When it considers as the resin substrate 2 of such a configuration, since lightweight-ization can be attained, it is effective.

[0046] Moreover, the light-scattering pattern 8 is formed by giving and carrying out surface roughening of the minute concavo-convex side to the rear face 7 of the resin substrate 2 selectively by screen-stencil. Since-izing of the pattern configuration can be carried out [detailed] as compared with the light-scattering pattern 8 shown in drawing 3 in the case of the light-scattering pattern 8 which is in a concavo-convex side and is formed as shown in drawing 6 and a dot image is not checked, it is not necessary to form the diffusion plate 11.

[0047] It is the predetermined include angle theta 0 by considering as the prism plate 12 equipped with the prism unit P with which a formula 2 is filled also in this source equipment of sheet-like light. Since the beam of light which carries out incidence can be made refracted in the direction of a transverse plane and all the chief rays of that incident ray advance to a beam-of-light directional change side, loss can be abolished.

[0048] Although what is necessary is just the matter which passes a beam of light efficiently as a raw material used for the prism plate 12 when carrying out this invention, since the transparency distance of a beam of light is almost the same as that of the board thickness of the prism plate 12 and very short, the transparency like the raw material used for the resin substrate 2 is not required. For this reason, the others, base film, and prism part which are used for the resin substrate 2 other than acrylic resin may consist of another members. [raw material / (after-mentioned)]

[0049] Moreover, the creation approach of the prism plate 12 can apply the various shaping approaches, such as machining of a cut, grinding, etc. or cast shaping (the approach of adding a prism part to a base film with UV hardening resin is also selectable), extrusion molding, heat pressing, and injection molding.

[0050] Acrylic resin is [that what is necessary is just the matter which passes light efficiently as a raw material of the resin substrate 2] most suitable from the transparency and workability. However, especially as operation of this invention, it is not limited to this, it replaces with this, and the transparence resin of various thermoplasticity, such as vinyl chloride resin, polycarbonate resin, olefin system resin, and styrene resin, etc. is usable. Moreover, inorganic transparent materials, such as thermosetting transparence resin, such as EBOKISHI resin and allyl compound diethylene glycol carbonate resin, and various glass ingredients, are also applicable depending on the case.

[0051] As the creation approach of the resin substrate 2, although application of the various shaping approaches, such as machining of a cut, a grinding process, etc. or cast shaping, extrusion molding, heat pressing, and injection molding, is possible, from the point of productivity, the injection-molding method is most excellent.

[0052] In the gestalt of this operation, although considered as the dot-like pattern with which area consistencies differ, it is [that what is necessary is just what an area consistency increases] good [the light-scattering pattern 6] also as patterns, such as a configuration which consists of the polygon, stellate, the ellipse forms, curves, and straight lines of a triangle, a square, etc., as a pattern configuration is not limited to this and separates from the light source lamp 1.

[0053] Moreover, although the film which vapor-deposited the metals (for example, silver, aluminum, etc.) currently used as a reflecting plate 9 is most suitable in respect of the property and handling nature, it may replace with this and the metal plate which carried out speculum side processing, and the reflector which vapor-deposits and constitutes a metal on the frame for inserting the source equipment of

sheet-like light of this invention are sufficient as it. In addition, various kinds of reflectors, such as a white reflecting plate which consisted of paper, plastics, etc., are applicable.

[0054]

[Example] As an example of the source equipment of sheet-like light of this invention, the source equipment of sheet-like light of the following configurations was created, and the brightness was observed.

[0055] An example -1 is source equipment of sheet-like light of a configuration of being shown in drawing 1 explained in the column of the gestalt of operation. As a resin substrate 2, the transparent plate made of acrylic resin (size: 240mmx160mm, board thickness:3mm) which ground the perimeter side flat and smooth was created with injection molding. The light-scattering pattern 8 is given by the screen-stencil method by the dot pattern (pattern pitch: 1mm, diameter:of minimum dot0.7mm, diameter:of maximum dot 1) to which an area consistency becomes large as it separates from the light source lamp 1. At this time, the acrylic vinyl resin containing the glass bead for diffusing and/or reflecting a beam of light was used for the ink for screen-stencil.

[0056] The haze value (haze value was measured according to the measuring method of a publication to JIS:K7105 "the optical characteristic test method of plastics" at this time) of the light-scattering pattern 8 adjusted the amount of the glass bead contained in ink, and created five kinds of dispersion patterns 8 so that it might become about 90, 85 and 80, and 75 or 70%. Magnitude and five kinds of pattern pitches of the configuration of the dispersion pattern 8 are altogether the same.

[0057] A cold cathode tube (periphery diameter: 2.6mm, die length of 240mm) is used as a light source lamp 1 which keeps predetermined distance and contacts along the 1 side-edge side 3 where the diameter of the minimum dot of the long side of the resin substrate 2 and the dispersion pattern 8 is given. The lamp reflector 4 and a reflector 6 use the PET film which made silver vapor-deposit. moreover, the reflecting plate made from foaming polyester was used for the reflecting plate 9, and the diffusion plate 13 used for it the polyester film which was alike and carried out the coat of the dispersion bead.

[0058] here -- high -- brightness is measured about five kinds of source equipments of sheet-like light equipped with the dispersion pattern 8 with which above-mentioned haze value differs in order to offer the brightness source equipment of sheet-like light, and to choose the haze value of the desirable dispersion pattern 8 first. At this time, since measurement of brightness is made in order to choose the haze value of the best dispersion pattern 8, the source equipment of sheet-like light has not formed the prism plate 12.

[0059] In five kinds of source equipments of sheet-like light with which the above-mentioned haze value differs, brightness is measured by the approach described below and the outgoing radiation angular distribution of the beam of light emitted on a screen is observed. As shown in drawing 7 (a), the middle-of-the-screen section of the source equipment of sheet-like light is made into a reference point O, the brightness measuring device K is kept on a screen from a reference point O, predetermined distance (50cm) is kept in the vertical (transverse plane) direction, and the part in which you made it located is made into 0 times. And as shown in drawing 4 (b), centering on a reference point 0, the brightness measuring device K is moved in the direction of the 1 side-edge side 3 and the side edge side 5 to 70 degrees, respectively, and brightness is measured for every predetermined include angle.

[0060] Measurement distance (distance from a reference point O to the head of the brightness measuring device K) is regularity (50cm) irrespective of migration of the brightness measuring device K. At this time, migration of the brightness measuring device K in the direction of the 1 side-edge side 3 is considered as plus, and migration of the brightness measuring device K in the direction of the side edge side 5 is expressed with minus. The brightness measuring device K has turned on the cold cathode tube which used the luminance meter (BM-7, 1 degree of visual fields) by TOPCON CORP., and was used as a light source lamp 1 by the sine wave with a tube electric current 5mArms and a burning frequency of 60kHz.

[0061] Here, brightness (unit: cd/m2) is measured with the brightness measuring device K. however, if whenever [angle-of-visibility] is set to theta, brightness is 1 / twice [costheta] the actual luminous density (the amount [in / whenever / an certain angle-of-visibility / theta] of flux of lights per unit solid angle), and does not express the luminous density in theta whenever [each angle-of-visibility]. Therefore, in order to make it correspond to actual luminous density, a flux of light ratio is defined as the formula 3 shown below, the value of the measured brightness is converted into a flux of light ratio, and it is plotting on the graph shown in drawing 8 and drawing 9 .

[0062] flux of light ratio (%) =(brightness measured value [in / brightness measured-value xcostheta / whenever / angle-of-visibility / in / whenever / angle-of-visibility / theta / theta= 0 degree]) x -- 100 [0063] Based on an above-mentioned measuring method, the brightness of the source equipment of sheet-like light is measured, and the result of having calculated the flux of light ratio from the formula 3 is shown in

drawing 8 R> 8. Here The source equipment of sheet-like light of 90% of haze value of the light-scattering pattern 8 The source equipment of sheet-like light of 90% of haze value of a sample -1 and the light-scattering pattern 8 The source equipment of sheet-like light of 70% of haze value of a sample -4 and the light-scattering pattern 8 is made [the source equipment of sheet-like light of 85% of haze value of a sample -1 and the light-scattering pattern 8 / the source equipment of sheet-like light of 80% of haze value of a sample -2 and the light-scattering pattern 8] into the sample -5 for the source equipment of sheet-like light of 75% of haze value of a sample -3 and the light-scattering pattern 8.

[0064] It is gently-sloping distribution gradually as it becomes such steep distribution that haze value is low and haze value becomes high so that clearly from drawing 8 . Since it was more effective to be distribution which has a big peak (it is steep) since the prism plate 12 is changed in the fixed direction of a request of the travelling direction of a beam of light by refraction, it found that 80% or less was desirable for the haze value of the dispersion pattern 8.

[0065] The source equipment of sheet-like light equipped with the prism plate 12 was created having used haze value of the dispersion pattern 8 as 70% in this example -1, and brightness was measured. It is the include angle theta 0 in which a beam of light carries out incidence to the prism plate 12 with the graph of drawing 8 since the direction of outgoing radiation of a chief ray is about 52 degrees. It is about 52 degrees.

[0066] The prism plate 12 is created with the acrylic resin whose refractive index (n) is 1.49, and it is theta 2 whenever [tilt-angle / of the plane of incidence 13 of the prism unit P]. It is theta 3 whenever [tilt-angle / of a formula 2 to the beam-of-light directional change side 14] as 60 degrees, 70 degrees, 75 degrees, 80 degrees, and 85 degrees, respectively. It asked by count. A count result becomes theta3 =58.2 degree at the time of theta3 =59.2 degree and theta2 =85 degree at the time of theta3 =60.1 degree and theta2 =80 degree at the time of theta3 =61 degree and theta2 =75 degree at the time of theta3 =62.7 degree and theta2=70 degree, when it is theta2 =60 degree. From the count result based on the above-mentioned formula 2, five kinds of prism plates 12 were created. At this time, the board thickness of the prism plate 12 sets to 0.1mm, and is fixed in a pitch at 0.1mm.

[0067] And the source equipment of sheet-like light of drawing 1 equipped with the five above-mentioned kinds of prism plates 12, respectively was created five kinds, and brightness was measured by the same measuring method as ****. The result is shown in drawing 9 . An axis of abscissa is whenever [angle-of-visibility / theta], and an axis of ordinate is a relative luminance ratio. A relative luminance ratio sets brightness measured value of theta= 0 degree to 100 (%) whenever [in the source equipment of sheet-like light equipped with the prism plate 12 created using the prism unit (theta2 =60 degree and theta3 =62.7 degree) P / angle-of-visibility], and expresses each measurement of luminance as a relative value.

[0068] As shown in drawing 9 , it is theta 2 whenever [tilt-angle / of plane of incidence 13]. Although it becomes high brightness so that it becomes large, it is theta 2 whenever [tilt-angle]. When 75 degrees was exceeded, it turned out that it does not change so in property. Therefore, it is theta 2 whenever [tilt-angle]. 70 degrees or more, although 75 degrees is exceeded desirably, it is theta 2 whenever [tilt-angle]. If it enlarges, since the vertical angle of the prism unit P will become small in connection with it, it is theta 2 whenever [from the field of processing of the prism plate 12 / tilt-angle]. It is desirable to choose 80 degrees or less.

[0069] Then, the configuration of the source equipment of sheet-like light of an example -2 is explained. In the example -2, the source equipment of sheet-like light explained based on drawing 5 thru/or drawing 6 was created. As a resin substrate 2, the plate (size: board thickness:3mm by the side of 240mmx 160mm and the 1 side-edge side 3, board thickness:1mm of the side edge side 7) of the transparent wedge configuration made of acrylic resin was created with injection molding. At this time, the minute irregularity for giving the light-scattering pattern 8 beforehand to the metal mold for the undersides of the resin substrate 2 is formed. Surface roughening processing of the irregularity of metal mold is carried out so that the haze value of the imprinted light-scattering pattern 8 may become 70%. The light-scattering pattern 8 is a dot pattern to which an area consistency becomes large, and is given in a fixed pattern pitch (pattern pitch: 0.1mm, diameter:of minimum dot0.07mm, diameter:of maximum dot0.1mm) as it separates from the light source lamp 1.

[0070] It creates with the acrylic resin whose refractive index (n) is 1.49, and the prism plate 12 is theta 2 whenever [tilt-angle / of the plane of incidence 13 of the prism unit P]. It considered as 75 degrees, and it asked by count from the formula 2, and theta3 =60.1 cost whenever [tilt-angle / of the beam-of-light directional change side 14]. At this time, the board thickness of the prism plate 12 sets to 0.1mm, and is fixed in a pitch at 0.1mm. Other configurations are the same as that of an example -1.

[0071] It measured by the same approach as the measuring method which mentioned the brightness in

theta above whenever [each angle-of-visibility / of such source equipment of sheet-like light], and the almost same property as an example -1 was checked.
[0072] as mentioned above, the source equipment of sheet-like light as an example of this invention sets up the include angle of the prism unit P of the prism plate 12 based on a formula 2 -- high -- it became clear that the brightness source equipment of sheet-like light could be offered.
[0073]
[Effect of the Invention] As mentioned above, as explained in full detail, the source equipment of sheet-like light of this invention can carry out incidence of the beam of light with which the chief ray is converging to a prism plate by limiting the haze value of a light-scattering pattern. And since the prism plate is constituted based on the relation of whenever [incident angle / of the beam of light which carries out incidence to an include angle and a prism plate of a prism unit of a prism plate with which the chief ray of the beam of light which carries out outgoing radiation serves as the direction of a transverse plane from a prism plate] since the travelling direction of the beam of light with which the chief ray is converging is made refracted in respect of beam-of-light directional change of a prism unit and can be changed into the screen perpendicular direction (the direction of a transverse plane) of the source equipment of sheet-like light -- high -- the brightness source equipment of sheet-like light becomes realizable.
[0074] Moreover, since the include angle of a prism unit can be set that all the chief rays of the beam of light which carries out incidence from the plane of incidence of the prism unit P by having drawn the relation of whenever [incident angle / of the beam of light which carries out incidence to the include angle and prism plate of a prism unit of a prism plate] advance to a beam-of-light directional change side, loss of much more beams of light can be suppressed.
[0075] Thus, since the function of a prism unit can be demonstrated to the maximum extent, high brightness and the low-power-ized source of sheet-like light are realizable.

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the structure of the source equipment of sheet-like light of one example of this invention.
[Drawing 2] It is the schematic diagram of the prism plate for explaining the prism unit which is the important section of this invention.
[Drawing 3] It is a schematic diagram for explaining the light-scattering pattern of the source equipment of sheet-like light of this invention shown in drawing 1 .
[Drawing 4] It is theta 2 and theta 3 whenever [tilt-angle / of a prism unit]. And incidence include angle theta 0 It is the graph showing relation.
[Drawing 5] Drawing 1 is the sectional view showing the structure of the source equipment of sheet-like light of one example of different this invention.
[Drawing 6] It is a schematic diagram for explaining the light-scattering pattern of the source equipment of sheet-like light of this invention shown in drawing 5 .
[Drawing 7] It is a schematic diagram for explaining how measuring the brightness of the source equipment of sheet-like light of this invention.
[Drawing 8] It is the graph showing the measurement-of-luminance result for the haze value decision of a light-scattering pattern.
[Drawing 9] It is the graph showing the result of having measured the brightness of the source equipment of sheet-like light of this invention.
[Drawing 10] It is the sectional view showing the structure of the conventional source equipment of sheet-like light.
[Drawing 11] It is a schematic diagram for explaining the light-scattering pattern of the source equipment of sheet-like light shown in drawing 10 .
[Drawing 12] It is the sectional view showing the structure of another conventional source equipment of sheet-like light with drawing 10 .
[Drawing 13] It is a schematic diagram for explaining the light-scattering pattern of the source equipment of sheet-like light shown in drawing 12 .
[Drawing 14] It is a schematic diagram for explaining the progress condition of the beam of light of the source equipment of sheet-like light shown in drawing 10 .
[Drawing 15] It is the sectional view showing the structure of another conventional source equipment of sheet-like light with drawing 12 .
[Drawing 16] It is a schematic diagram for explaining the progress condition of the beam of light in the prism plate of the source equipment of sheet-like light shown in drawing 12 .

[Drawing 17] It is a schematic diagram for explaining the progress condition of the outgoing radiation beam of light from the prism plate of the source equipment of sheet-like light shown in drawing 12 .
[Drawing 18] It is the schematic diagram showing the incident ray and outgoing radiation beam of light of a prism plate of the source equipment of sheet-like light which are shown in drawing 12 .
[Drawing 19] It is the graph showing the relation of the outgoing radiation beam of light and permeability based on whenever [incident angle / of the incident ray to the prism plate measured based on drawing 18].
[Drawing 20] It is the sectional view showing the structure of another conventional source equipment of sheet-like light with drawing 15 .
[Drawing 21] It is a schematic diagram for explaining the progress condition of the beam of light in the prism plate of the source equipment of sheet-like light shown in drawing 20 .
[Drawing 22] It is a schematic diagram for explaining the progress condition of the beam of light in the prism plate of the source equipment of sheet-like light different from drawing 21 .
[Description of Notations]
2 Resin Substrate
8 Light-Scattering Pattern
12 Prism Plate
13 Plane of Incidence

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平10－206643

(43)公開日　平成10年(1998)８月７日

(51)Int.Cl.[6]		識別記号	ＦＩ		
Ｇ０２Ｂ	6/00	３３１	Ｇ０２Ｂ	6/00	３３１
Ｆ２１Ｖ	8/00	６０１	Ｆ２１Ｖ	8/00	６０１Ａ
					６０１Ｃ
Ｇ０２Ｂ	5/04		Ｇ０２Ｂ	5/04	Ａ
Ｇ０２Ｆ	1/1335	５３０	Ｇ０２Ｆ	1/1335	５３０

審査請求　未請求　請求項の数６　ＦＤ　（全 12 頁）

(21)出願番号　特願平9－20958

(22)出願日　平成９年(1997)１月20日

(71)出願人　000114215
ミネベア株式会社
長野県北佐久郡御代田町大字御代田4106－73

(72)発明者　鈴木　信吾
静岡県磐田郡浅羽町浅名1743－１　ミネベア株式会社開発技術センター内

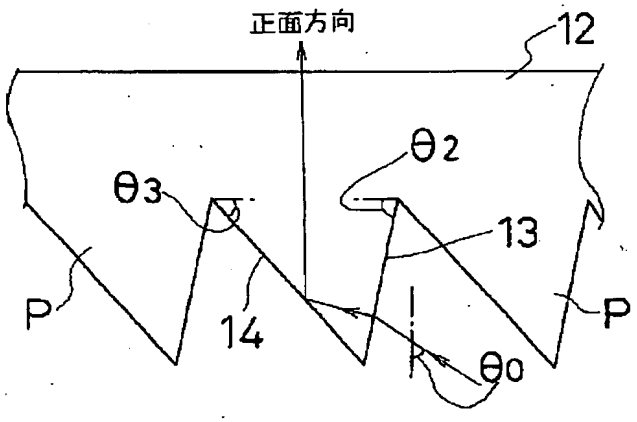
(74)代理人　弁理士　萼　経夫　（外２名）

(54)【発明の名称】　面状光源装置

(57)【要約】

【課題】　本発明は、光の損失を最小限に抑え、高効率で高輝度な面状光源装置を提供する。

【解決手段】　光散乱パターンの曇価を限定することによって、主光線が集束している光線をプリズム板１２に入射させ、プリズム板１２から出射する光線の主光線が正面方向となるような、プリズム板１２のプリズム単位Ｐの傾斜角度θ_2，θ_3およびプリズム板１２に入射する光線の入射角度θ_0との関係に基づいてプリズム板１２を構成している。このため光線を、プリズム単位Ｐの光線方向変換面１４で屈折させて、面状光源装置の画面垂直方向に進行させることができるので、高輝度な面状光源装置が実現可能となる。



1

【特許請求の範囲】

【請求項１】　透光性材料からなる樹脂基板の少なくとも一面以上の側端面付近に光源ランプを当接させて構成するサイドライト方式の面状光源装置において、

プリズム単位を等間隔に備えるプリズム板を、該プリズム単位のある面を前記樹脂基板に当接する向きに前記樹脂基板の表面に設け、さらに、前記光源ランプから発する光線がプリズム板に入射する際の入射面の角度を７０°以上とし、

光線を反射させる光散乱パターンを前記樹脂基板の裏面に設け、該散乱パターンの曇価を８０％以下としたことを特徴とする面状光源装置。

【請求項２】　前記プリズム板の上部および下部に拡散板を設けたことを特徴とする請求項１に記載の面状光源装置。

【請求項３】　前記樹脂基板は、光源ランプを当接した側端面から遠ざかるにつれて厚みが減じる断面形状ほぼ楔形であることを特徴とする請求項１または２に記載の面状光源装置。

【請求項４】　前記光散乱パターンは、光散乱物質を含有するインクを用いて樹脂基板に印刷されることを特徴とする請求項１ないし３のいずれかに記載の面状光源装置。

【請求項５】　前記光散乱パターンは、前記樹脂基板の裏面に微小な凹凸面を施すことによって形成されることを特徴とする請求項１ないし３のいずれかに記載の面状光源装置。

【請求項６】　前記プリズム板のプリズム単位は、光線が入射する前記入射面と該入射面から入射した光線が進行する光線方向変換面を備えており、前記入射面の傾斜角度θ_2、前記光線方向変換面の傾斜角度θ_3およびプリズム板へ光線が入射する角度θ_0との関係が

$\theta_3 = 90° + [\mathrm{Sin}^{-1}\{\mathrm{Sin}(\theta_2 - \theta_0)/n\} - \theta_2]/2$

を満たすことを特徴とする請求項１ないし５のいずれかに記載の面状光源装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、看板や各種表示装置等の背面照明手段に用いる薄型の面状光源装置に関するものであり、特に、液晶表示装置の背面照明手段として用いられる面状光源装置の構造に関するものである。

【０００２】

【従来の技術】近年、コンピュータ等の表示装置として、軽量かつコンパクト化のニーズに応えるべく薄型で見やすい背面光源機構を有する液晶表示装置が用いられている。このような背面光源機構を実現する手段として、図１０に示すサイドライト方式（導光板方式）の面状光源装置の説明をする。２１は、面状光源装置の光源として冷陰極管（ＣＣＦＬ）または熱陰極管（ＨＣＦＬ）等を用いる直線状の光源ランプである。透光性の高い材料で形成される樹脂基板２２は断面形状ほぼ矩形であり、その一側端面２３に沿って、前記光源ランプ２１を所定距離をおいて配置させる。

2

【０００３】光源ランプ２１の周面において一側端面２３と対向しない周面は、銀等を蒸着したランプリフレクタ２４で覆われている。ランプリフレクタ２４を設けることによって、光源ランプ２１の発光光線の多くは、一側端面２３から樹脂基板２２内に進入することができる。そして、樹脂基板２２の一側端面２３以外の側面（例えば、図１０および図１１に示す一側端面２３の対向面である側端面２５）には、反射テープ等からなる反射材２６が付加されている。

【０００４】樹脂基板２２の裏面２７（図１０の下方）には、光源ランプ２１からの距離に左右されることなく、面状光源装置の画面を均一に発光させるための光散乱パターン２８（詳細後述）が形成されており、そのさらに下方には、反射板２９が配置されている。これら反射材２６や反射板２９を設けることにより、樹脂基板２２の側面や裏面２７に向かって進行する光線を、樹脂基板２２の内部に進行するように反射させ、樹脂基板２２の表面３０（図１０の上方）以外の面から光線が放出することを防止している。

【０００５】そして、樹脂基板２２の表面３０には、その全面を覆うように拡散板３１が設けられている。拡散板３１は、光散乱パターン２８によって反射および拡散される光線に起因する、光散乱パターン２８のみが輝いて見える現象（通常、これをドットイメージという）を除去するために設けられている。

【０００６】前記光散乱パターン２８は、例えば、特開平５－１３４２５１号に開示されるように、光拡散反射物質を含んだ媒体をドット状に、樹脂基板２２の裏面２７全面に渡ってスクリーン印刷方式で塗布されている。

【０００７】図１１に示すように、光散乱パターン２８は、光源ランプ２１が配設されている一側端面２３からその対向面である側端面２５に向かうにつれて、ドットの径が徐々に大きくなるように印刷されているので、光源ランプ２１から遠くなるにしたがって、裏面２７の単位面積当たりに、光拡散反射物質を含んだ媒体が占める割合が多くなる（以下、単位面積当たりに所定物質が占める割合を面積密度という）。光散乱パターン２８は、図１１において、断面ではないが判りやすいように斜線を施した。

【０００８】このように、樹脂基板２２の裏面２７に形成した光拡散反射物質を含んだ媒体を塗布して施す光散乱パターン２８の面積密度を変えると、樹脂基板２２の表面３０から放出する光線量を変化させることができるので、光源ランプ２１に近い部分のみが明るく発光することがない。

【０００９】また、上述のように、スクリーン印刷方式

にて樹脂基板２２に施される光散乱パターン２８に代えて、例えば特願平７－２０８４６１号に示すように、樹脂基板２２の裏面２７に直接微小な凹凸面を形成して、その凹凸面によって光を拡散および／または反射させる光散乱パターン２８（図１２参照）を形成することにより、上述の光散乱パターン２８と同等の機能を発揮させることも可能である。

【００１０】ところで、上述の拡散板３１は、拡散板３１内部を進行する光線を拡散させる性質を有するので光線を重ね合わせることになり、ドットイメージを除去することができる。したがって、拡散板３１の拡散性を増加させるとドットイメージは、より除去されやすくなるが、同時に、光線が拡散してしまうことになるので輝度が低下してしまう。このため、ドットイメージを除去可能な範囲で拡散性の最も低い拡散板３１が選択されている。

【００１１】これに代えて、例えば特願平８－９７６３３号に示すように、図１２および図１３の面状光源装置が開示されている。その構成は、図１０および図１１に示す面状光源装置とほぼ同一であるが、拡散板３１を樹脂基板２２の表面３０に設ける代わりに、光散乱パターン２８の形状を視認不可能なまでに微細化したパターンとするものである。このように微細化した光散乱パターン２８を施すと、樹脂基板２２の内部を進行する光線が光散乱パターン２８で拡散および／または反射しても、光散乱パターン２８のパターンが細かいので、光散乱パターン２８のみが輝いて見えることはない。

【００１２】ここで、図１２および図１３に示す光散乱パターン２８は、スクリーン印刷方式にて施す光散乱パターン２８（図１０参照）とほぼ同一に機能する微小な凹凸面によって形成されている。また、図１２において樹脂基板２２の形状は、光源ランプ２１の一側端面２３から遠ざかるにつれて厚みが減じるほぼ楔状である。このような樹脂基板２２とした場合には、樹脂基板２２の軽量化に有効である。

【００１３】図１４は、このように構成されたサイドライト方式の面状光源装置における光線の進行状態を説明するための模式的な断面図である。上述した構成の面状光源装置において、光源ランプ２１からの発光光線は、一側端面２３に対向する面以外を覆うランプリフレクタ２４に反射することによって、その多くが樹脂基板２２の内部へと進行する。

【００１４】裏面２７に向かって進行する光源ランプ２１からの発光光線は、樹脂基板２２の裏面２７にて反射されるか、光散乱パターン２８にて拡散および反射されるか、または、裏面２７および光散乱パターン２８を通過し下方の反射板２９にて反射され、表面３０へ向かって進行する。そして、表面３０の上方に備わる拡散板３１を透過する。このとき、拡散板３１内を進行する光線は、ある程度拡散されることによってドットイメージが

除去される。一方、表面３０に向かって進行する光源ランプ２１からの発光光線は、樹脂基板２２の表面で、その多くが反射され、裏面２７に向かって進行する。

【００１５】このように、樹脂基板２２内を進行する光線は、樹脂基板２２の表面３０および裏面２７、反射材２９の境界面にて反射を繰り返しながら進行する。以下、画面上に放出されるまで繰り返す。ここで、光散乱パターン２８にて拡散および反射される光線の多くは、境界面にて反射されない所定角度で進行するため画面上に放出される。

【００１６】光散乱パターン２８に上述した面積密度の分布を与えていることにより、樹脂基板２２内を進行する光線は、光源ランプ２１から遠くなるにつれ、光散乱パターン２８で反射される率が多くなるので、光源ランプ２１の配置位置にかかわらず均一な画面発光の面状光源装置が実現可能となっている。

【００１７】ところで、前記光散乱パターン２８の拡散性が大きい場合には、樹脂基板２２の表面３０から出射する光線は、進行方向の角度分布が広くなるので、面状光源装置の正面方向（以下、観測位置という）からは、比較的明るく観測されるが、この場合、拡散性が大きいために光散乱パターン２８による吸収損失が大きくなるという問題がある。このため、光散乱パターン２８の拡散性を低下させると、樹脂基板２２の表面３０から出射する光線の主光線の進行方向は、画面垂直方向に対して所定角度θ_0（図１４参照）傾きを持つ。このような場合には、観測位置からは、画面が暗く観測されてしまう。

【００１８】この角度θ_0の主光線を画面垂直方向に変換して輝度の向上を図る手段として、実用新案登録公報第２５０７０９２号に開示されているように、図１５に示す面状光源装置が考案されている。図１５に示す面状光源装置の構成は、図１０に基づいて説明した面状光源装置とほぼ同一であるが、拡散板３１の画面側（図１５の上方）を覆うようにプリズム板３２を設けた点が異なる。プリズム板３２には、断面形状三角形のプリズム単位Ｐを配設させたプリズム列が備わり、このプリズム単位Ｐで光線を反射させることにより、画面上に放射する光線の放出角度を画面垂直方向へ変換させることができる。

【００１９】図１６は、図１５に示す面状光源装置において、プリズム板３２への光線の進行を模式的に示した図である。この図において、図示しない光源ランプは、右側に位置しているので、プリズム板３２に入射する光線は、プリズム単位Ｐにおける左側の面（以下、光線方向変換面３３という）に進行する。図１５において、拡散板３１から出射する光線は、その上方に設けられるプリズム板３２に入射するので、そのプリズム板３２への入射角度（すなわち拡散板３１からの出射角度）を角度θ_0とする。なお、拡散板３１を設けない場合には、樹

脂基板２２から出射した光線がプリズム板３２へ入射するが、角度θ_0は上述と同様に考えてよい。

【００２０】このとき、光線方向変換面３３のプリズム板３２の水平面に対する傾斜角度をθ_1とする。傾斜角度θ_1は、下記の数式１によって求まるということが数学的に既知である。

【００２１】$Sin\theta_1 = Sin\theta_0 / \{n^2 + 1 - 2(n^2 - Sin^2\theta_0)^{1/2}\}^{1/2}$

【００２２】上記の数式１において、ｎは、基材の屈折率、すなわちプリズム板３２の屈折率である。プリズム板３２は屈折率１．４９のアクリル樹脂で作成し、角度θ_0が５０°のとき、上記数式１にて傾斜角度θ_1を計算すると、およそ７０°となる。

【００２３】この数式１にて得られる傾斜角度θ_1を有するプリズム板３２について、図１７および図１８の模式図に基づいて、以下に検討する。ここでは、上述の計算によって求めた条件（ｎ＝１．４９、角度θ_0＝５０、傾斜角度θ_1＝７０）のプリズム板３２について検討を行った。

【００２４】図１７に示すように、プリズム板３２の水平面に垂直方向の垂線Ａを考え、光線の入射方向を＋側と定義する。傾斜角度θ_1が７０°のとき、－側の出射範囲は－２０°が最大となり、－２０°に近づくにしたがって、光線が屈折する際のフレネル反射損失が増大する。さらに、光線が全反射されることによって、光線の進行方向を変換することができない領域ができてしまう。

【００２５】そして、図１８に示すように、傾斜角度θ_1を７０°として、プリズム板３２に入射する角度θ_0を変化させて、光線方向変換面３３からの主光線の出射角度ϕおよび光線の透過率を測定し、その関係を図１９に示す。図１９に示す図表から明らかなように、傾斜角度θ_1を７０°としたプリズム板３２を用いた場合には、出射角度ϕは、ほぼ－２０°から＋２０°の範囲となっているので、画面上から観測する際の視野角度が極端に狭いことが判った。そして、出射角度ϕの幅が大きくなる場合には、光線透過率が著しく低下するため、効率が低下することが判った。

【００２６】上述した図１５の面状光源装置に代えて、図２０に示す面状光源装置が特公平７－２７１３６号に開示される面状光源装置が発明されている。この面状光源装置は、図１５に示す面状光源装置とほぼ同一の構造であるが、プリズム板３２の配置が異なっており、プリズム板３２のプリズム単位Ｐを樹脂基板２２に当接する向きに配置している。

【００２７】このようにプリズム板３２を配置すると、図２１の光線の進行方向を示す模式図に示すように、プリズム単位Ｐを構成する面は、それぞれプリズム板３２に入射する光線が進行する入射面３４と光線方向変換面３３’を構成することになる。ここで、入射面３４の傾

斜角度をθ_2、光線方向変換面３３’の傾斜角度をθ_3と定める。

【００２８】該特公平７－２７１３６号の実施例には、面状光源装置として好適に使用されるプリズム単位Ｐの条件としては、角度θ_0が５５°で、プリズム板３２をアクリル樹脂で作製した場合に、傾斜角度θ_2が５８°ないし４８°のとき、傾斜角度θ_3を６５°ないし７５°とし、傾斜角度θ_2が６５°ないし７５°のとき、傾斜角度θ_3を５８°ないし４８°であることが開示されている。この代表的な形状として、傾斜角度θ_2を５５°、傾斜角度θ_3を６８°としている。

【００２９】

【発明が解決しようとする課題】ここで、特公平７－２７１３６号のに開示されている傾斜角度θ_2を５５°、傾斜角度θ_3を６８°としたプリズム単位Ｐを有するプリズム板３２内の光線の進行を検討する。

【００３０】図２２に示すように、上記のようにプリズム単位Ｐの入射面３４および光線方向変換面３３’を決定すると、プリズム板３２からの出射光線は、正面方向に大して１５°右側に傾斜している。プリズム板３２に入射する光線の角度θ_0＝５５°とすると、入射面３４から入射する光線のうち光線方向変換面３３’に進行する光線帯Ｂは所望の角度でプリズム板３２から放射されるが、光線方向変換面３３’に進行しない光線帯Ｃは、プリズム板３２の境界面（図２２の上方）に進行するため損失になってしまうという問題がある。

【００３１】このため、図１５に基づいて説明した面状光源装置と比較して、視野角度の制約はなくなるものの、依然として効率の点で満足できるものではなかった。すなわち本発明は、上記問題点を解決するために種々の検討の結果至ったものであり、プリズム板を用いて画面の正面方向に光線を進行させる際に、より高効率に光線を進行させ得るプリズム板を提供し、これにより電力消費を低下させ、かつ高輝度な面状光源装置を提供することを目的とする。

【００３２】

【課題を解決するための手段】課題を解決するための手段として、請求項１の発明では、透光性材料からなる樹脂基板の少なくとも一面以上の側端面付近に光源ランプを当接させて構成するサイドライト方式の面状光源装置において、プリズム単位を等間隔に備えるプリズム板を、該プリズム単位のある面を前記樹脂基板に当接する向きに前記樹脂基板の表面に設け、さらに、前記光源ランプから発する光線がプリズム板に入射する際の入射面の角度を７０°以上とし、光線を反射させる光散乱パターンを前記樹脂基板の裏面に設け、該散乱パターンの曇価を８０％以下としたことを特徴とする面状光源装置である。

【００３３】請求項２の発明では、前記プリズム板の上部および下部に拡散板を設けたことを特徴とする。

7

【００３４】請求項３の発明では、前記樹脂基板は、光源ランプを当接した側端面から遠ざかるにつれて厚みが減じる断面形状ほぼ楔形であることを特徴とする。

【００３５】請求項４の発明では、前記光散乱パターンは、光散乱物質を含有するインクを用いて樹脂基板に印刷されることを特徴とする。

【００３６】請求項５の発明では、前記光散乱パターンは、前記樹脂基板の裏面に微小な凹凸面を施すことによって形成されることを特徴とする。

【００３７】請求項６の発明では、前記プリズム板のプリズム単位は、光線が入射する前記入射面と該入射面から入射した光線が進行する光線方向変換面を備えており、前記入射面の傾斜角度θ_2、前記光線方向変換面の傾斜角度θ_3およびプリズム板へ光線が入射する角度θ_0との関係が

$\theta_3 = 90° + [Sin^{-1}\{Sin(\theta_2 - \theta_0)/n\} - \theta_2]/2$

を満たすことを特徴とする。

【００３８】

【発明の実施の形態】本発明の第一の実施の形態としての面状光源装置は、図１ないし図３に示される。図１および図３に示すように、１は、直線状の光源である光源ランプである。透光性の高い材料で形成される樹脂基板２は断面形状ほぼ矩形であり、その一側端面３に沿って、前記光源ランプ１を所定距離をおいて配置させる。樹脂基板２の一側端面３に対向する以外の光源ランプ１の周面は、銀等を蒸着したランプリフレクタ４で覆われている。そして、樹脂基板２の一側端面３以外の側面（例えば、一側端面３の対向面である側端面５）には、反射材６が設けられている。

【００３９】樹脂基板２の裏面７（図１の下方）には、面状光源装置の画面を均一に発光させるための光散乱パターン８が、図３に示すパターン形状にスクリーン印刷方式または塗布にて形成されており、そのさらに下方には、反射板９が配置されている。そして、樹脂基板２の表面１０には、その全面を覆うようにドットイメージを除去するために拡散板１１が設けられている。さらにその上方には、本発明の要部であるプリズム板１２が、樹脂基板２に対向する向きにプリズム単位Ｐを位置させて設けられている。ここで、プリズム板１２を構成するプリズム単位Ｐは、後述する条件に基づいて作製されているものとする。

【００４０】プリズム板１２のプリズム単位Ｐの角度について、以下に説明する。本実施の形態では、光散乱パターン８の曇価を７０％として形成した面状光源装置について説明する。プリズム板１２のプリズム単位Ｐは、樹脂基板２に対向する向きに配置されているので、プリズム板１２に入射する光線は、図２の光線の進行方向を示す模式図に示すように、プリズム単位Ｐを構成する面は、それぞれプリズム板１２に入射する光線が進行する

8

入射面１３と光線方向変換面１４を構成する。入射面１３の傾斜角度をθ_2、光線方向変換面１４の傾斜角度をθ_3と定める。

【００４１】そして、図２に示すように、入射面１３から入射する光線の主光線を、すべて光線方向変換面１４に進行させ、かつ、画面に対して垂直である正面方向へ屈折させてプリズム板３２から光線を放出させるために、傾斜角度θ_2、傾斜角度θ_3およびプリズム板１２へ光線の入射する角度θ_0との関係を以下に示す数式２として導き出した。上記所望のプリズム板１２とするためには、プリズム単位Ｐは、数式２をほぼ満足する。

【００４２】$\theta_3 = 90° + [Sin^{-1}\{Sin(\theta_2 - \theta_0)/n\} - \theta_2]/2$

【００４３】上記の数式２において、ｎは、基材の屈折率、すなわちプリズム板１２の屈折率である。上記数式２によって導き出される傾斜角度θ_2、傾斜角度θ_3および角度θ_0との関係を図４の（ａ）および（ｂ）の図表に示す。図４（ａ）は、プリズム板１２を屈折率１．４９のアクリル樹脂で作製した場合であり、一方、図４（ｂ）は、プリズム板１２を屈折率１．４９のアクリル樹脂で作製した場合である。

【００４４】上記の数式２を満たすプリズム単位Ｐを備えるプリズム板１２とすることで、所定の角度θ_0で入射する光線を正面方向に屈折させることができ、かつ、その入射光線の主光線はすべて光線方向変換面１４に進行するので、損失をなくすことができる。

【００４５】続いて、本発明の第二の実施の形態として、図５および図６に示す面状光源装置を示す。第一の実施の形態と異なる箇所は、樹脂基板２の形状、および、光散乱パターン８のみであるから相違点のみ説明する。樹脂基板２の形状は、光源ランプ１の一側端面３から遠ざかるにつれて厚みが減じるほぼ楔状とした。このような形状の樹脂基板２とした場合には、軽量化が図れるために有効である。

【００４６】また、光散乱パターン８は、スクリーン印刷にて樹脂基板２の裏面７に部分的に微小な凹凸面を施し粗面化することによって形成されている。図６に示すように、凹凸面にで形成される光散乱パターン８の場合には、図３に示す光散乱パターン８と比較してパターン形状を微細化できるため、ドットイメージが確認されないので、拡散板１１を設けなくてよい。

【００４７】この面状光源装置においても、数式２を満たすプリズム単位Ｐを備えるプリズム板１２とすることで、所定の角度θ_0で入射する光線を正面方向に屈折させることができ、かつ、その入射光線の主光線はすべて光線方向変換面に進行するので、損失をなくすことができる。

【００４８】本発明を実施する場合において、プリズム板１２に用いる素材としては、光線を効率よく通過させる物質であればよいが、光線の透過距離がほぼプリズム

板１２の板厚と同一でごく短いので、樹脂基板２に用いる素材ほどの透明性は要求されない。このため、アクリル樹脂のほかに、樹脂基板２に用いられる素材（後述）のほか、ベースフィルムとプリズム部分を別部材で構成してもよい。

【００４９】また、プリズム板１２の作成方法は、切削および研削等の機械加工またはキャスト成形（ＵＶ硬化樹脂によってプリズム部分をベースフィルムに付加する方法も選択可能）、押し出し成形、熱加圧成形、射出成形等の各種成形方法が適用可能である。

【００５０】樹脂基板２の素材としては、光を効率よく通過させる物質であれば良く、その透明性、加工性からアクリル樹脂が最も適している。しかしながら、本発明の実施としては、特にこれに限定されるものではなく、これに代えて、塩化ビニル樹脂、ポリカーボネイト樹脂、オレフィン系樹脂、スチレン系樹脂等の各種熱可塑性の透明樹脂等が使用可能である。また、エポキシ樹脂、アリルジグリコールカーボネイト樹脂等の熱硬化性透明樹脂や各種ガラス材料等の無機透明材料も場合によっては適用可能である。

【００５１】樹脂基板２の作成方法としては、切削および研削加工等の機械加工またはキャスト成形、押し出し成形、熱加圧成形、射出成形等の各種成形方法の適用が可能であるが、生産性の点からは射出成形法が最も優れている。

【００５２】光散乱パターン６は、本実施の形態においては、面積密度の異なるドッド状のパターンとしたが、パターン形状はこれに限定されるものでなく、光源ランプ１から離れるにしたがって面積密度が増加するものであればよく、例えば、三角形および四角形等の多角形や星形、楕円形、曲線と直線とから構成される形状等のパターンとしてもよい。

【００５３】また、反射板９として使用している金属（例えば、銀、アルミ等）を蒸着したフィルムは、その特性および取扱性の点で最も適しているが、これに代えて、金属鏡面加工した金属板や、本発明の面状光源装置を挿入するためのフレームに金属を蒸着して構成する反射材でも良い。その他、紙およびプラスチック等で構成された白色の反射板等、各種の反射材を適用可能である。

【００５４】

【実施例】本発明の面状光源装置の実施例として、以下の構成の面状光源装置を作成し、その輝度を観測した。

【００５５】実施例－１は、実施の形態の欄にて説明した図１に示す構成の面状光源装置である。樹脂基板２として、全周面を平滑に研磨した透明なアクリル樹脂製の平板（サイズ：２４０mm×１６０mm、板厚：３mm）を射出成形により作成した。光散乱パターン８は、光源ランプ１から離れるにしたがって、面積密度が大きくなるドットパターン（パターンピッチ：１mm、最小ドット径：０．７mm、最大ドット径：１）でスクリーン印刷方式で施される。このとき、スクリーン印刷のためのインクは、光線を拡散および／または反射させるためのガラスビーズを含有したアクリルビニル樹脂を用いた。

【００５６】光散乱パターン８の曇価（このとき曇価は、ＪＩＳ：Ｋ７１０５「プラスチックの光学的特性試験法」に記載の測定方法にしたがって測定した）は、ほぼ９０，８５，８０，７５，７０％となるように、インクに含有するガラスビーズの量を調整して、５種類の散乱パターン８を作成した。散乱パターン８の形状は、大きさ、パターンピッチともに５種類すべて同一である。

【００５７】樹脂基板２の長辺かつ散乱パターン８の最小ドット径の施されている一側端面３に沿って所定距離をおいて当接する光源ランプ１として冷陰極管（外周直径：２．６mm、長さ２４０mm）を使用する。ランプリフレクタ４および反射材６は、銀を蒸着させたＰＥＴフィルムを使用する。また、反射板９には、発泡ポリエステル製の反射板を使用し、拡散板１３は、に散乱ビーズをコートしたポリエステルフィルムを用いた。

【００５８】ここで、高輝度な面状光源装置を提供するために、まず、望ましい散乱パターン８の曇価を選択するべく、上述の曇価の異なる散乱パターン８を備える５種類の面状光源装置について輝度を測定する。このとき面状光源装置は、最良の散乱パターン８の曇価を選択するために輝度の測定がなされるものであるから、プリズム板１２を設けていない。

【００５９】上記曇価の異なる５種類の面状光源装置において、以下に述べる方法で輝度を測定し、画面上に放出する光線の出射角度分布を観測する。図７（ａ）に示すように、面状光源装置の画面中央部を基準点Ｏとし、輝度測定装置Ｋを、基準点Ｏから画面に垂直（正面）方向に所定距離（５０ｃｍ）をおいて位置させた箇所を０度とする。そして、図４（ｂ）に示すように、基準点０を中心に、一側端面３および側端面５の方向に、それぞれ輝度測定装置Ｋを７０度まで移動させて、所定角度ごとに輝度を測定する。

【００６０】測定距離（基準点Ｏから輝度測定装置Ｋの先端までの距離）は、輝度測定装置Ｋの移動にかかわらず一定（５０ｃｍ）である。このとき、一側端面３の方向への輝度測定装置Ｋの移動をプラスとし、側端面５の方向への輝度測定装置Ｋの移動をマイナスで表している。輝度測定装置Ｋは、トプコン社製輝度計（ＢＭ－７，視野１°）を使用し、光源ランプ１として使用した冷陰極管は、管電流５ｍＡｒｍｓ、点灯周波数６０ＫＨｚの正弦波で点灯している。

【００６１】ここで、輝度測定装置Ｋで測定されるのは、輝度（単位：ｃｄ／m_2）である。しかしながら、輝度は、視野角度をθとすると、実際の光束密度（ある視野角度θにおける単位立体角当りの光束量）の１／ｃ

ｏｓθ倍となっており、各視野角度θにおける光束密度を表していない。よって、実際の光束密度に対応させるために、以下に示す数式３に光束比を定義し、測定した輝度の値を光束比に換算して、図８および図９に示す図表にプロットしている。

【００６２】光束比（％）＝（視野角度θにおける輝度測定値×ｃｏｓθ／視野角度θ＝０°における輝度測定値）×１００

【００６３】上述の測定方法に基づいて、面状光源装置の輝度を測定し、数式３から光束比を計算した結果を図８に示す。ここで、光散乱パターン８の曇価９０％の面状光源装置を試料－１、光散乱パターン８の曇価９０％の面状光源装置を試料－１、光散乱パターン８の曇価８５％の面状光源装置を試料－２、光散乱パターン８の曇価８０％の面状光源装置を試料－３、光散乱パターン８の曇価７５％の面状光源装置を試料－４、光散乱パターン８の曇価７０％の面状光源装置を試料－５としている。

【００６４】図８から明らかなように、曇価が低いほど急峻な分布となり曇価が高くなるにしたがって徐々になだらかな分布になっている。プリズム板１２は、屈折によって光線の進行方向を所望の一定方向へ変化させるので、大きなピークを有する（急峻な）分布である方が効果的であるため、散乱パターン８の曇価は８０％以下が望ましいことが判った。

【００６５】この実施例－１においては散乱パターン８の曇価を７０％として、プリズム板１２を備える面状光源装置を作成し、輝度を測定した。図８の図表により、主光線の出射方向は、およそ５２°であるから、光線がプリズム板１２へ入射する角度θ_0はおよそ５２°である。

【００６６】プリズム板１２を、屈折率（ｎ）が１．４９であるアクリル樹脂によって作成し、プリズム単位Ｐの入射面１３の傾斜角度θ_2をそれぞれ６０°，７０°，７５°，８０°，８５°として、数式２から光線方向変換面１４の傾斜角度θ_3を計算によって求めた。計算結果は、θ_2＝６０°のときθ_3＝６２．７°、θ_2＝７０°のときθ_3＝６１°、θ_2＝７５°のときθ_3＝６０．１°、θ_2＝８０°のときθ_3＝５９．２°、θ_2＝８５°のときθ_3＝５８．２°となる。上記数式２に基づいた計算結果から、５種類のプリズム板１２を作成した。このとき、プリズム板１２の板厚は０．１ｍｍとし、ピッチを０．１ｍｍで一定である。

【００６７】そして、上記５種類のプリズム板１２をそれぞれ備える図１の面状光源装置を５種類作成し、上述と同様の測定方法にて輝度を測定した。その結果を図９に示す。横軸は視野角度θであり、縦軸は相対輝度比である。相対輝度比は、θ_2＝６０°，θ_3＝６２．７°のプリズム単位Ｐを用いて作成したプリズム板１２を備える面状光源装置における視野角度θ＝０°の輝度測定値を１００（％）として、それぞれの輝度測定を相対値として表している。

【００６８】図９に示すように、入射面１３の傾斜角度θ_2が大きくなるほど高輝度になるが、傾斜角度θ_2が７５°を越えると、それほど特性的に変化しないことが判った。したがって、傾斜角度θ_2は、７０°以上、望ましくは７５°を越えるものであるが、傾斜角度θ_2を大きくすると、それに伴ってプリズム単位Ｐの頂角が小さくなってしまうので、プリズム板１２の加工の面から、傾斜角度θ_2は８０°以下を選択することが望ましい。

【００６９】続いて、実施例－２の面状光源装置の構成を説明する。実施例－２では、図５ないし図６に基づいて説明した面状光源装置を作成した。樹脂基板２として、透明なアクリル樹脂製の楔形状の板（サイズ：２４０ｍｍ×１６０ｍｍ、一側端面３側の板厚：３ｍｍ、側端面７の板厚：１ｍｍ）を射出成形により作成した。この時、あらかじめ樹脂基板２の下面用の金型に、光散乱パターン８を施すための微小な凹凸を形成しておく。金型の凹凸は、転写された光散乱パターン８の曇価が７０％となるように粗面化加工されている。光散乱パターン８は、光源ランプ１から離れるにしたがって、面積密度が大きくなるドットパターンであり、一定のパターンピッチ（パターンピッチ：０．１ｍｍ、最小ドット径：０．０７ｍｍ、最大ドット径：０．１ｍｍ）で施される。

【００７０】プリズム板１２は、屈折率（ｎ）が１．４９であるアクリル樹脂によって作成し、プリズム単位Ｐの入射面１３の傾斜角度θ_2を７５°として、数式２から計算によって求め、光線方向変換面１４の傾斜角度θ_3＝６０．１とした。このとき、プリズム板１２の板厚は０．１ｍｍとし、ピッチを０．１ｍｍで一定である。その他の構成は、実施例－１と同一である。

【００７１】このような面状光源装置の各視野角度θにおける輝度を上述した測定方法と同一の方法にて測定し、実施例－１とほぼ同様な特性を確認した。

【００７２】上述したように、本発明の実施例としての面状光源装置は、プリズム板１２のプリズム単位Ｐの角度を数式２に基づいて設定することによって、高輝度な面状光源装置を提供できることが判明した。

【００７３】

【発明の効果】以上、詳述したように、本発明の面状光源装置は、光散乱パターンの曇価を限定することによって、主光線が集束している光線をプリズム板に入射させることができる。そして、プリズム板から出射する光線の主光線が正面方向となるような、プリズム板のプリズム単位の角度およびプリズム板に入射する光線の入射角度との関係に基づいてプリズム板を構成しているので、主光線が集束している光線の進行方向を、プリズム単位の光線方向変換面にて屈折させて、面状光源装置の画面

垂直方向（正面方向）に変更できるので、高輝度な面状光源装置が実現可能となる。

【００７４】また、プリズム板のプリズム単位の角度およびプリズム板に入射する光線の入射角度との関係を導き出したことによって、プリズム単位Ｐの入射面から入射する光線の主光線は、すべて光線方向変換面に進行するようにプリズム単位の角度を定めることができるので、さらに多くの光線の損失を抑えることができる。

【００７５】このように、プリズム単位の機能を最大限に発揮できることから、高輝度かつ低消費電力化された面状光源を実現できる。

【図面の簡単な説明】

【図１】本発明の一実施例の面状光源装置の構造を示す断面図である。

【図２】本発明の要部であるプリズム単位を説明するためのプリズム板の概略図である。

【図３】図１に示す本発明の面状光源装置の光散乱パターンを説明するための概略図である。

【図４】プリズム単位の傾斜角度θ_2，θ_3および入射角度θ_0の関係を示す図表である。

【図５】図１とは異なる本発明の一実施例の面状光源装置の構造を示す断面図である。

【図６】図５に示す本発明の面状光源装置の光散乱パターンを説明するための概略図である。

【図７】本発明の面状光源装置の輝度を測定する方法を説明するための概略図である。

【図８】光散乱パターンの曇価決定のための輝度測定結果を示す図表である。

【図９】本発明の面状光源装置の輝度を測定した結果を示す図表である。

【図１０】従来の面状光源装置の構造を示す断面図である。

【図１１】図１０に示す面状光源装置の光散乱パターンを説明するための概略図である。

【図１２】図１０とは別の従来の面状光源装置の構造を示す断面図である。

【図１３】図１２に示す面状光源装置の光散乱パターンを説明するための概略図である。

【図１４】図１０に示す面状光源装置の光線の進行状態を説明するための概略図である。

【図１５】図１２とは別の従来の面状光源装置の構造を示す断面図である。

【図１６】図１２に示す面状光源装置のプリズム板内の光線の進行状態を説明するための概略図である。

【図１７】図１２に示す面状光源装置のプリズム板からの出射光線の進行状態を説明するための概略図である。

【図１８】図１２に示す面状光源装置のプリズム板の入射光線および出射光線を示す概略図である。

【図１９】図１８に基づいて測定したプリズム板への入射光線の入射角度に基づく出射光線および透過率の関係を示す図表である。

【図２０】図１５とは別の従来の面状光源装置の構造を示す断面図である。

【図２１】図２０に示す面状光源装置のプリズム板内の光線の進行状態を説明するための概略図である。

【図２２】図２１とは別の面状光源装置のプリズム板内の光線の進行状態を説明するための概略図である。

【符号の説明】

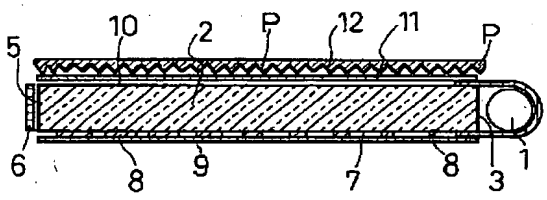
２　樹脂基板

８　光散乱パターン

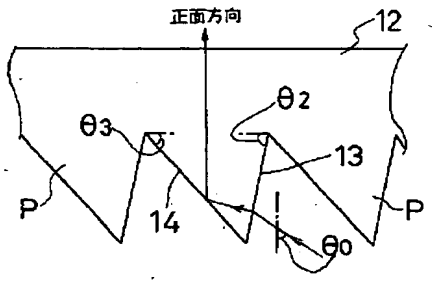
１２　プリズム板

１３　入射面

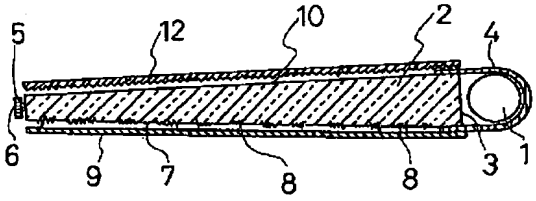
【図１】



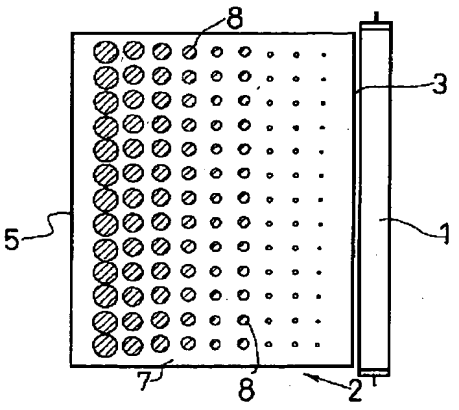
【図２】



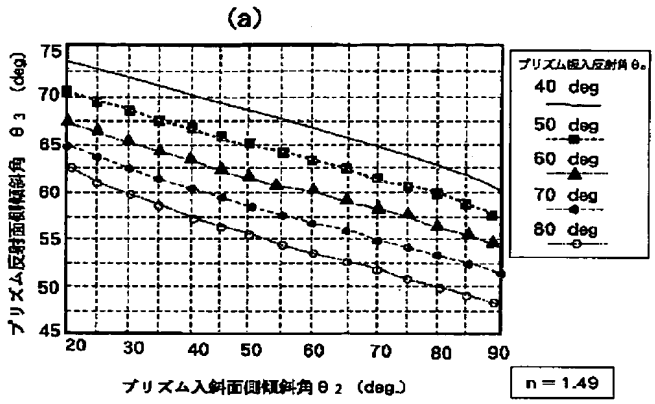
【図５】



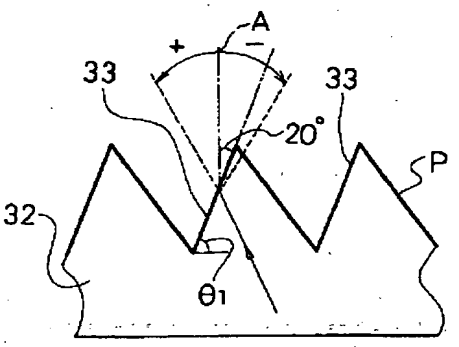
【図３】

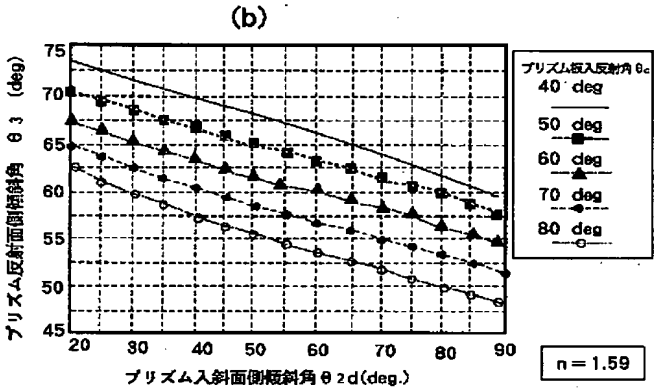


【図４】

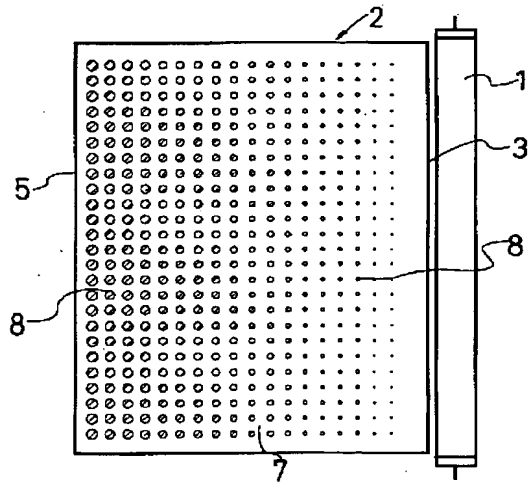


【図１７】

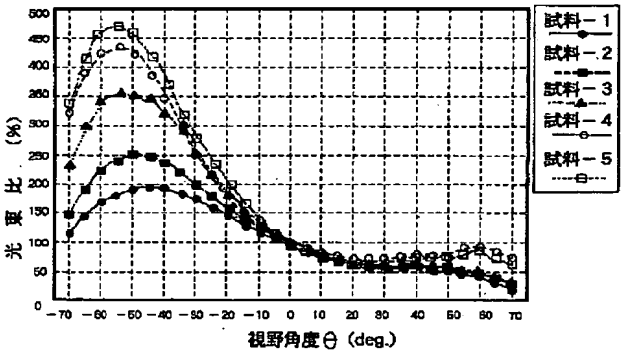




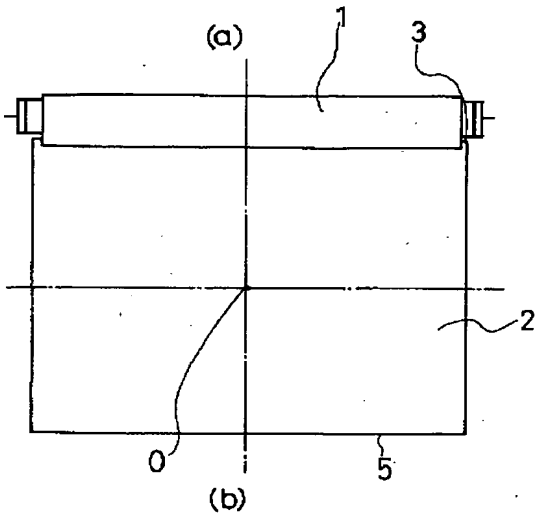
【図６】



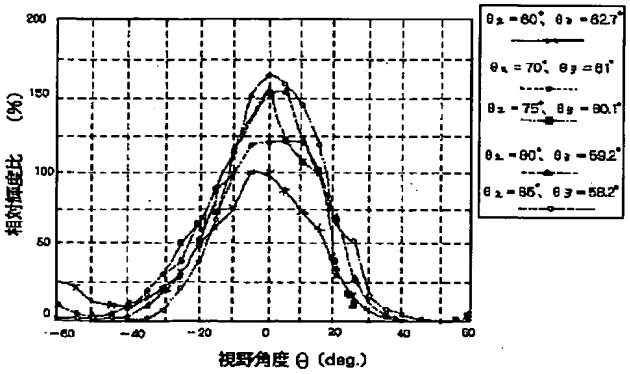
【図８】



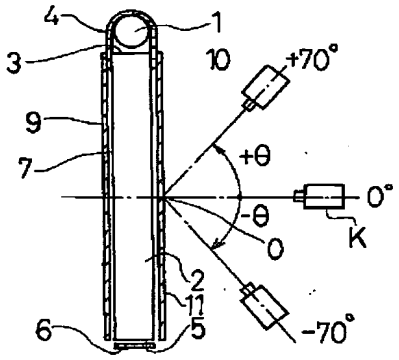
【図７】



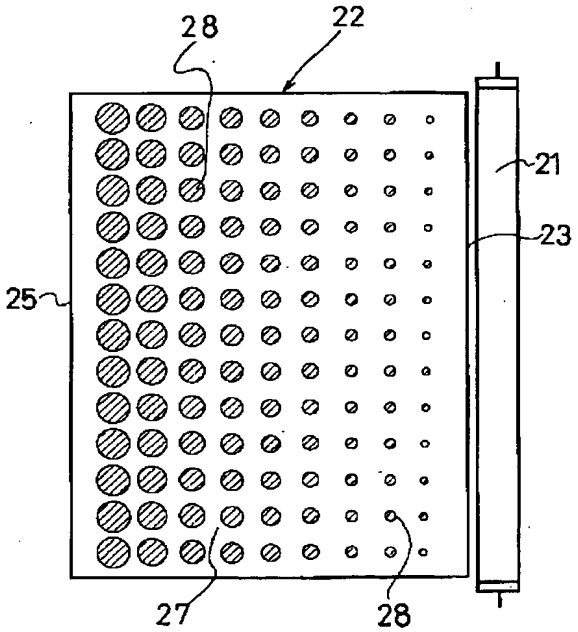
【図９】



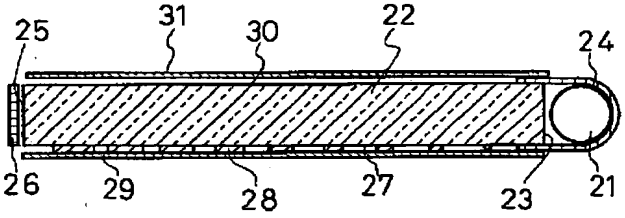
【図１１】



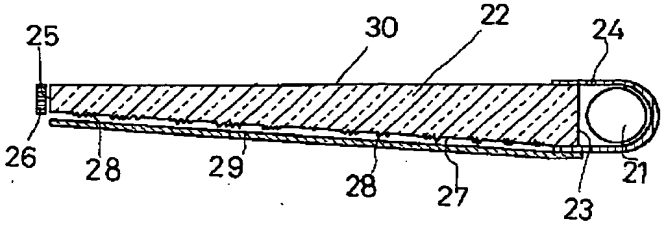
【図１０】

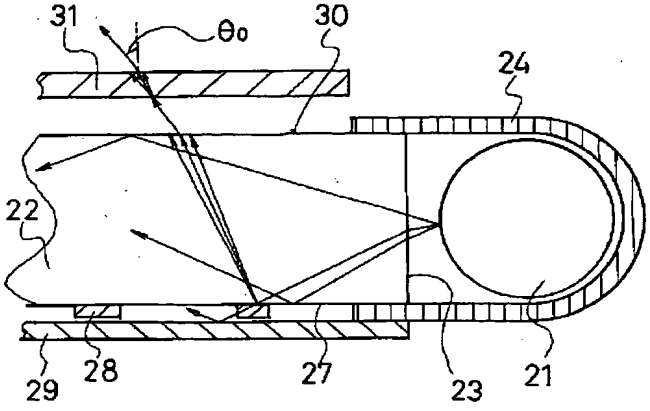


【図１４】

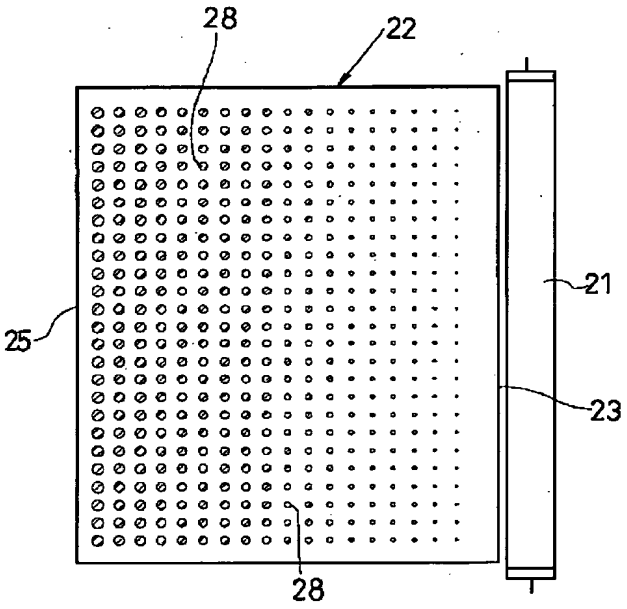


【図１２】

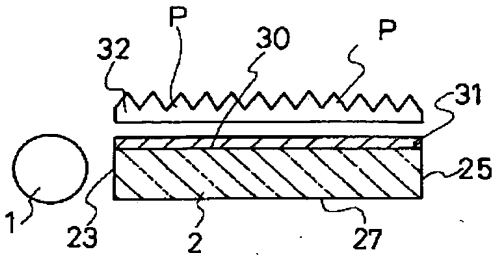




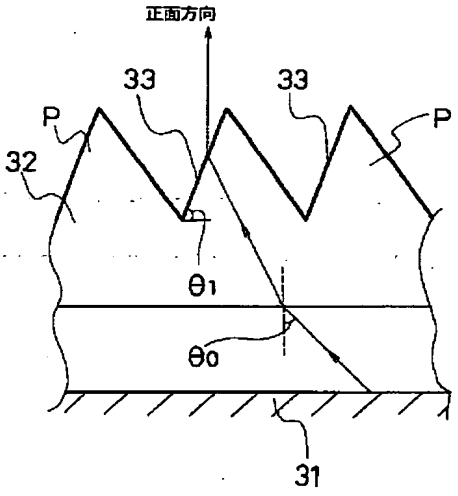
【図１３】



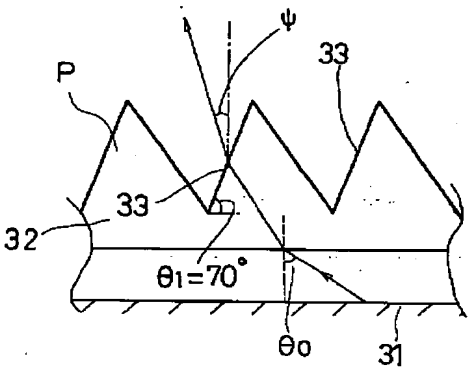
【図１５】



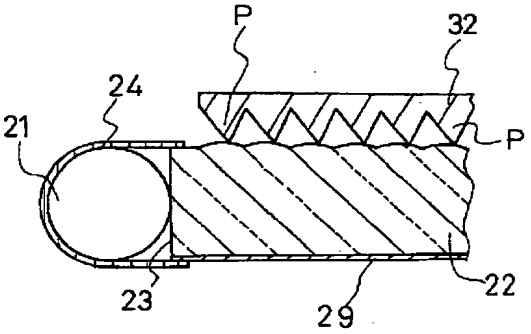
【図１６】



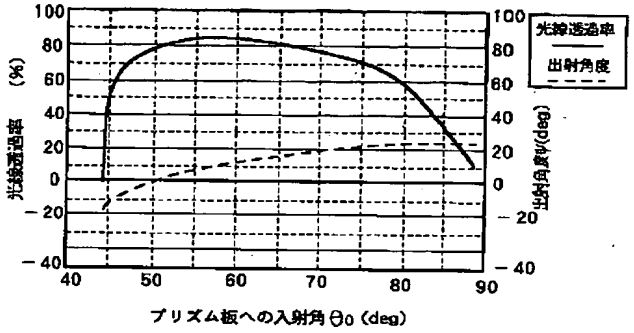
【図１８】



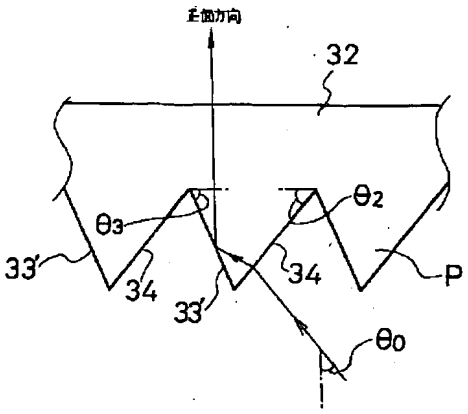
【図２０】



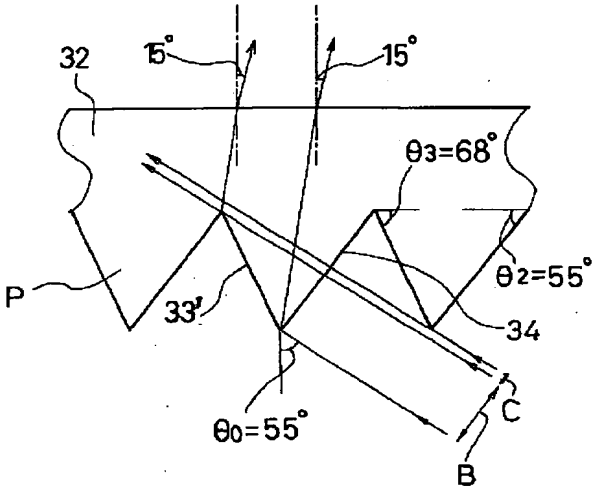
【図１９】



【図２１】



【図２２】



This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.